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(74) Agents: STEFFEY, Charles, E. et al.; Schwegman, Lund-  
berg, Woessner & Kluth, P.A., P.O. Box 2938, Minneapolis,  
MN 55402 (US).

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(71) Applicant (for all designated States except US):  
NU-TEIN, LLC [US/US]; 1633 Eustis Street, St.  
Paul, MN 55108 (US).

(71) Applicants and

(72) Inventors: HOFFMAN, Mark [US/US]; 17150 Jackrab-  
bit Path, Lakeville, MN 55044 (US). BAUGH, David  
[US/US]; 2500 Queensland Lane, Plymouth, MN 55447  
(US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): AHERN, Michael  
[US/US]; 304 Hamline Avenue South, St. Paul, MN 55105  
(US). WALSH, David [US/US]; 5223 Old Washington  
Course, Hollywood, SC 29449 (US).

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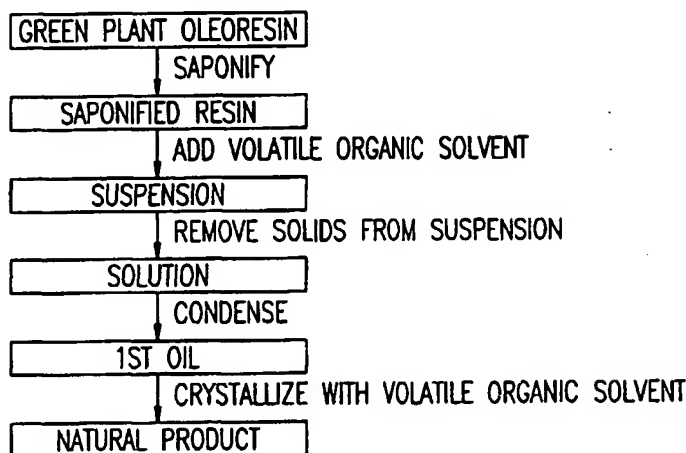
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For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: ISOLATION OF LUTEIN FROM ALFALFA



(57) Abstract: The present invention provides a process for an industrial scale extraction and purification of xanthophylls ( e.g., lutein and zeaxanthin) from plant material (e.g., alfalfa or other leafy green crops having high levels of chlorophyll). The process involves harvesting lutein rich alfalfa, extracting an oleoresin from the alfalfa leaves, saponifying the oleoresin, extracting and extracting lutein using a series of solvent extractions specific for oleoresin obtained from alfalfa or other leafy green plants.

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2004/006721

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 C07C403/08 A23K1/16 A23L1/03 A61K7/00 A61K31/07 A61P1/04 A61P35/00 A61P9/00 A61P27/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 C07C A23K A23L A61K A61P		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the International search (name of data base and, where practical, search terms used) EP0-Internal, BEILSTEIN Data, WPI Data, PAJ, CHEM ABS Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 382 714 A (F. KHACHIK) 17 January 1995 (1995-01-17)	1-14, 17-71, 95,96,98
Y	claim 5; examples 1,2; table I	15,16
A	US 6 329 557 B1 (G. RODRIGUEZ, ET AL.) 11 December 2001 (2001-12-11)	1-71,95, 96,98
Y	column 4, line 9 - line 20; claim 12	15,16
Y	US 6 504 067 B1 (R. MONTOYA-OLVERA, ET AL.) 7 January 2003 (2003-01-07)	15,16
Y	column 1, line 43 - line 52	
Y	US 6 376 722 B1 (V.E. RIDAURA SANZ, ET AL.) 23 April 2002 (2002-04-23)	15,16
	column 6, line 66 - column 7, line 5; claims 1,3	
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search  31 August 2004		Date of mailing of the international search report  01.12.2004
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer  English, R

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2004/006721

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 044 954 A (INDUSTRIAL ORGANICA) 18 October 2000 (2000-10-18) claims 1-5 -----	15,16

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2004/006721

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-72, 95, 96, 98

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-72,95,96,98

Natural product and a method for obtaining it  
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2. claims: 73-76 (in part), 86, 97 (in part)

Use of a natural product in the treatment of an ulcer  
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3. claims: 73-76 (in part), 87, 97 (in part)

Use of a natural product in the treatment of cancer  
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4. claims: 73-76 (in part), 88, 97 (in part)

Use of a natural product in the treatment of heart disease  
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5. claims: 73-76 (in part), 89, 97 (in part)

Use of a natural product in the treatment of macular  
degeneration  
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6. claims: 77-80

Neutraceutical formulation comprising a natural product  
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7. claims: 81-85

Cosmetic composition comprising a natural product  
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8. claims: 90-94

Dietrary supplement comprising a natural product  
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/006721

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5382714	A	17-01-1995	AT 191475 T	15-04-2000
			DE 69516031 D1	11-05-2000
			DE 69516031 T2	14-09-2000
			DK 672655 T3	03-07-2000
			EP 0672655 A1	20-09-1995
			ES 2147261 T3	01-09-2000
			JP 2790212 B2	27-08-1998
			JP 8092205 A	09-04-1996
			KR 214430 B1	02-08-1999
			PT 672655 T	29-09-2000
-----				
US 6329557	B1	11-12-2001	AU 6627701 A	17-12-2001
			CN 1434792 T	06-08-2003
			EP 1289916 A2	12-03-2003
			WO 0194279 A2	13-12-2001
			JP 2003535835 T	02-12-2003
			NO 20025785 A	02-12-2002
-----				
US 6504067	B1	07-01-2003	WO 0128966 A2	26-04-2001
-----				
US 6376722	B1	23-04-2002	AU 1055799 A	24-05-1999
			EP 1030837 A1	30-08-2000
			WO 9923067 A1	14-05-1999
-----				
EP 1044954	A	18-10-2000	US 5959138 A	28-09-1999
			AU 1445899 A	15-06-1999
			BR 9814670 A	03-10-2000
			CA 2311394 A1	03-06-1999
			DE 69813626 D1	22-05-2003
			DE 69813626 T2	05-02-2004
			EP 1044954 A1	18-10-2000
			JP 2001524463 T	04-12-2001
			NO 20002648 A	24-07-2000
			CN 1278786 T	03-01-2001
			ES 2197518 T3	01-01-2004
			WO 9926914 A1	03-06-1999
			PT 1044954 T	29-08-2003
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